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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/766,618	01/27/2004	Yoshihide Senzaki	A-70028-1/MSS/TJH (463035)	3758
32940 7590 03/30/2007 DORSEY & WHITNEY LLP 555 CALIFORNIA STREET, SUITE 1000 SUITE 1000 SAN FRANCISCO, CA 94104			EXAMINER LEE, CHEUNG	
			ART UNIT 2812	PAPER NUMBER
SHORTENED STATUTORY PERIOD OF RESPONSE			MAIL DATE	DELIVERY MODE
3 MONTHS			03/30/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/766,618	<b>Applicant(s)</b> SENZAKI, YOSHIHIDE	
	<b>Examiner</b> Cheung Lee	<b>Art Unit</b> 2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 03 January 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1,3,4,6,10-12,14 and 15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3,4,6,10-12,14 and 15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Notice to Applicant***

1. Applicant's Amendment and Response to the Office Action mailed on July 31, 2006 has been entered and made of record.

### ***Response to Amendment***

2. In view of applicant's amendments and arguments filed on January 3, 2007, the rejections of claims 1, 3-4, 6, 8, 10-12 and 14-15 under 35 U.S.C. 103(a) as stated in the indicated Office Action have been withdrawn. Applicant's arguments have been rendered moot in view of the new or modified ground of rejection given below.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 3-4, 6, 10-12 and 14-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Callegari et al. (US Pat. 6664186; hereinafter "Callegari") in view of Buchanan et al. (US Pat. 6984591; hereinafter "Buchanan").
4. Referring to figures 12A-12H and related text, Callegari discloses [Re claim 1] a method of forming a multilayer dielectric film on a substrate 50, comprising the steps of: forming a metal silicate layer 55 on the surface of the substrate; forming a metal oxide layer 56 atop the metal silicate layer; and forming another metal silicate layer 57 atop

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the metal oxide layer, wherein said metal silicate layers each have a thickness (see fig. 12D) and a dielectric constant lower than the metal oxide layer. Zirconium, hafnium or a metal silicate can be used for lower layer 55 and upper layer 57, and aluminum oxide with  $ZrO_2$  or  $HfO_2$ , or aluminum oxide alone can be used for middle layer 56 as disclosed in Example 5. So, then the claimed limitation wherein said metal silicate layers each have a dielectric constant lower than the metal oxide layer is met (see MPEP 2123). Also, the two metal silicate layers 55, 57 each have a thickness lower than the metal oxide layer 56 as shown in figure 12D. Besides, the main motivation behind the use of high-K dielectric material for  $SiO_2$  gate replacement is the use of thicker dielectrics (col. 9, lines 38-43). So, it would have been obvious that the metal oxide is thicker than lower and upper metal silicate layers, because it would have been to prevent any leakage currents through the gate dielectric while making smaller devices (col. 1, lines 13-35). However, Callegari fails to disclose expressly wherein said metal oxide layer includes more than one metal element.

Referring to figures 4-12 and related text, Buchanan discloses a middle high K dielectric layer 56, which can be a relatively homogenous mixture such as a mixture of zirconium oxide and hafnium oxide (col. 24, lines 7-35).

Callegari also discloses wherein the dielectric materials comprising the multilayer structure with aluminum oxide are selected from the group including such as  $ZrO_2$ ,  $HfO_2$ , etc., doped or undoped mixtures, layers or combinations thereof (col. 11, lines 40-51).

Since Callegari discloses dielectric materials mixtures or combinations, it would have been obvious that the mixture of  $\text{ZrO}_2$  and  $\text{HfO}_2$  can be used, as shown in Buchanan. So, the claimed limitation is met.

5. Callegari discloses [Re claim 3] wherein said forming steps are carried out by any one of, or combination of, chemical vapor deposition (CVD), physical vapor deposition (PVD), atomic layer deposition (ALD), aerosol pyrolysis, spray coating or spin-on-coating; [Re claim 4] wherein said forming steps are carried out by chemical vapor deposition (CVD) and using an oxygen source selected from the group consisting of  $\text{O}_2$ ,  $\text{O}_3$ ,  $\text{NO}$ ,  $\text{N}_2\text{O}$ ,  $\text{H}_2\text{O}$ ,  $\text{OH}^-$ , alcohol, alkoxides, and  $\text{H}_2\text{O}_2$  (see Examples 2 and 5).

6. [Re claim 6] Callegari fails to disclose expressly wherein said metal oxide layer comprises a layer of a metal oxide having a dielectric constant in a range of 15 to 200 and wherein each of said metal silicate layers comprises a layer of a metal silicate having a dielectric constant in a range of 5 to 100. However, it would have been obvious to one of ordinary skill in the art at the time of the invention because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are *prima facie* obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily

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within skill or art) and *In re Aller*, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

Besides, if metal silicate containing one of the metals disclosed in Example 5 and aluminum oxide were used, as shown in specification, then the claimed limitations are met.

7. Callegari discloses [Re claim 10] wherein said metal silicate has the formula of  $M_xSiO_y$ , where M is a metal selected from the group consisting of Zr, Hf, Ti, V, Nb, Ta, Cr, Mo, W, Mn, Zn, Al, Ga, In, Ge, Sr, Pb, Sb, Bi, Sc, Y, La, Be, Mg, Ca, Sr, Ba, Th, Lanthanides (Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu), and mixtures thereof, x is a number in the range of 1 to 3, and y is a number in the range of 2 to 5; and [Re claim 11] wherein said metal silicate includes more than one metal element (see Example 5).

8. Callegari discloses [Re claim 12] wherein said metal silicate is selected from the group consisting of  $Zr_x-Si-O_y$  and  $Hf_x-Si-O_y$ , x is a number in the range of 1 to 3, and y is a number in the range of 2 to 5 (see Example 5).

9. [Re claims 14-15] Callegari fails to disclose expressly wherein said metal oxide layer has a thickness in a range of about 30 to 80Å; and wherein said metal silicate layers has a thickness of one to two atomic layers. However, it would have been obvious to an ordinary artisan to use the appropriate thickness for the layers to meet the requirements of a specification concerning leakage current, quality and cost.

It would have been obvious to one of ordinary skill in the art at the time of the invention because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These

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claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and *In re Aller*, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Cheung Lee whose telephone number is 571-272-5977. The examiner can normally be reached on Monday through Friday from 8:30AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on 571-272-1873. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Cheung Lee

March 28, 2007

  
MICHAEL LEBENTRITT  
SUPERVISORY PATENT EXAMINER